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The Journal of The Biblical Creation Society **£5.00**

Editorial:
Challenging the advance of Atheism

Origins 47

Over the past year or two, there has been a remarkable surge of militant atheism – evangelical in its fervour and fundamentalist in its blindness to reasoned arguments from theists. Atheism has become a lucrative business. "Some 500,000 hardcover copies are in print of Richard Dawkins's *"The God Delusion"* (2006); 296,000 copies of Christopher Hitchens's *"God Is Not Great: How Religion Poisons Everything"* (2007); 185,000 copies of Sam Harris's *"Letter to a Christian Nation"* (2006); 64,100 copies of Daniel C. Dennett's *"Breaking the Spell: Religion as a Natural Phenomenon";* and 60,000 copies of Victor J. Stenger's *"God: The Failed Hypothesis: How Science Shows that God Does not Exist"* (2007)." (*Wall Street Journal,* Monday, July 16, 2007). In both the UK and the US, leadership has been provided by Richard Dawkins, judging by sales of *The God Delusion* and his innumerable media opportunities.

A major event referred to as the *Beyond Belief Conference* was organized at the Salk Institute, La Jolla, USA from November 5–7, 2006. The organisers saw it as an opportunity to promote scientific atheism. A week later, on November 14, 2006, the US Center for Inquiry released the text of a "Declaration in Defense of Science and Secularism." This lumped Christianity in with many other examples of contemporary anti-science. These atheists are in no mood for dialogue.

Dawkins has been repeatedly challenged over the years about his impoverished and erroneous understanding of theology, but it is like water off a duck's back. His thinking about biblical Christianity has never been revised as a result of interacting with Christians. Fellow Oxford Professor Alister McGrath refers to this trait in the introduction of *The Dawkins Delusion?:* "[He] clearly has little interest in engaging religious believers, who will simply find themselves appalled by the flagrant misrepresentation of their beliefs and lifestyles. Is the case for atheism really so weak that it has to be bolstered by such half-baked nonsense? Dawkins pays his readers the highly dubious compliment of assuming that they will share his prejudices and ignorance about religion. [...] This is a very serious and troubling point. The total dogmatic conviction of correctness which pervades some sections of Western atheism today – wonderfully illustrated in *The God Delusion* – immediately aligns it with a religious fundamentalism which refuses to allow its ideas to be examined or challenged." (xii)

After the Oxford Union Huxley Memorial Debate (1986), Dawkins has declined to interact with creationists on the grounds that this will dignify our position and give onlookers grounds for thinking that we have an interest in science. However, he has always felt comfortable taking on theistic evolutionists (TEs). These occasions are always disappointing for us, because rarely is Dawkins challenged about his central thesis: he is supremely confident that Darwinism makes it possible to be an intellectually fulfilled atheist. He is not challenged on the evidence because TEs are nearly always card-carrying Darwinists. They think that God created by the process of evolution, and they regard Darwinism as the best evolutionary theory available. Where they do interact on this issue, they typically advance their "complementarity" message: God created using the evolutionary process. This style of argument invariably makes no impact because the atheists find it irrelevant. There are important matters here for us to consider.

All evolutionary atheists are philosophical naturalists who think that the chain of natural cause and effect has been continuous since the origin of the Cosmos. For them, *natural causation* is an essential element of their belief system. Some might allow discussion of a cosmic mind establishing the laws of causation, but this alternative implies only a transcendent character to the cosmic mind. It allows no place for the immanent God of the Scriptures. Curiously, even Richard Dawkins has made this concession. TEs have

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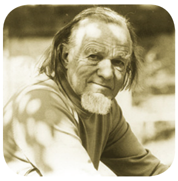

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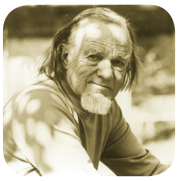
What can we learn from Francis Schaeffer?



Ranald Macaulay

The following was given as a talk by Ranald Macaulay at the European Leadership Forum 2007 in Eger, Hungary.

At the risk of oversimplification, Francis Schaeffer's vision can be expressed in two fundamental concerns:

- **True Truth**
- **True Spirituality**

As a young man he came in contact with the Christian faith in an almost unique way. During his late teens he happened to be reading classical philosophy. This showed him (a) that he had found the field of interest in which he felt most at home, ideas; and (b) that philosophy had no answers despite the fact that it dealt with what he called later 'the basic philosophic questions'. Plenty of questions, but no answers!

Then he found the Bible, or rather the Bible found him! He read alternately from the classical philosophers and from the Old Testament with the latter steadily displacing the former as he went along. 'Before I left Genesis 3', he once told me, 'I knew that this book had the answers to what the philosophers were asking'. Simply through his reading of Scripture he was born again. No one on the outside was helping. 'Before I reached the New Testament I was virtually a believer in Christ', he said. It was a somewhat lonely experience but it marked him forever: the Bible was sufficient in and of itself. Not surprisingly his life began to move in an entirely different direction.

From the very beginning, then, Schaeffer had a mind for what he called 'True-Truth'. He loved the Bible and its message of salvation first and foremost because it is 'true'. It accurately reflects the reality within which all human beings find themselves and against which, ultimately, they cannot revolt – try as they may.

The corollary of this was a sense of inescapable responsibility to unmask and challenge falsehood. Other religious and philosophical world-views, he realised, are basically 'lies' and/or distortions of the truth, as much in relation to the created order as in relation to God's acts of salvation through history. So Schaeffer's approach to 'apologetics' was already 'presuppositional' from the start. Begin with the Christian world-view and everything makes sense: start elsewhere and nothing does!

Without recourse to Van Til or Kuyper or Dooyeweerd, Schaeffer had discovered the ground-motif of Scripture they shared, namely the reformed perspective. He also agreed with their critique of 'evidentialism' but carefully distinguished himself from them – with Van Til certainly – over the practical implications of this. Human beings could be reasoned with and challenged intellectually, he argued, not because they share a common presupposition with the Bible, because evidently they don't, but because they are unavoidably creatures of the one true God. Surrounded by evidences of God's creation and actions in the real world – what he called the mannishness of man and the form of the universe – they inevitably stand, therefore, simply through their ordinary experience as human beings (though inconsistently within their alternative intellectual frameworks) on common ground with the Bible.

Schaeffer's experiences after moving to Europe in 1948 merely reinforced these passionately held convictions about the truthfulness of the Christian faith. The hollowness of life based on modernist presuppositions had already been expressed in the existentialist philosophy of men like Sartre and Camus and their intellectual capitulation was quickly echoed and enlarged by the hippie revolution. Europe was never the same again. In such a context what Schaeffer found he could do, always with great sympathy and gentleness but penetratingly because of his acute intellectual gifts, was to apply these theological convictions to the 'pulling down of strongholds' (2 Corinthians 10:4). He relentlessly exposed the inadequacies of all non-biblical thinking and tried to lead men and women to Christ. Hence the only authentic description he ever used of himself – not 'philosopher' or 'theologian' or 'intellectual' etc – but simply 'evangelist'!

This was already strikingly different from the run-of-the-mill evangelicalism then current. But what made it truly outstanding was the fact that Schaeffer carried on this ministry within the context of a highly personal and non-exploitative environment – the existence of L'Abri, a French word meaning 'The Shelter'. At great personal cost to himself and his wife, and needless to say therefore to his family, a constant though limited stream of individuals made their way to their home in the Swiss Alps. This slowly developed into a larger community and study centre, the first of eight such L'Abris now scattered around the globe. (see www.labri.org)

The reality behind this brings us to the second of Schaeffer's prime convictions – True Spirituality. For in a sense what happened to the Schaeffers in the second part of their life involved a type of 'burial' along the lines of what Jesus said about the seed. If it is to bear real fruit it must fall into the ground and die (John 12). Something like this happened to them in their willingness to branch out into a completely different life-style under God's supernatural leading. They deliberately turned from the organisational razamataz they had been accustomed to in the States and began to 'live by faith', making prayer the centre of L'Abri's 'methodology', not programs, or advertising or gimmicks. Edith Schaeffer's 'The L'Abri Story' describes what happened and certainly it too merits attention half a century later and stands for all time alongside the classics of missionary biography.

In hindsight, of course, one is able to see the extraordinary providence in all this. For what looked at the time bizarre and inefficient turned out to be just the sort of environment in which the pointlessness and inauthenticity of post-modern experience could best be challenged – a family, a small community in which the individual is supremely valued. This dual thrust of Schaeffer's work was necessary then and is all the more necessary now: modernism needs to be challenged intellectually and post-modernism needs to be shown something 'real'. Schaeffer was able to combine both within L'Abri.

Hence the relevance of Schaeffer's second abiding concern.

It was a theme he never tired of and one could say it was the very air he breathed. God has called us, he would say, not to programs but to personal experience, not to the imitation of the mechanical, but to the imitation of Christ. Whatever sphere of life one is called to Christianity has to be a moment-by-moment experience of the Living Christ. Hence the importance for him of prayer, of being led by the Spirit, of knowing weakness because of sacrifice and frustration because of the severities of the battle.

What remains to be asked of course is how much this or any of Schaeffer's many concerns actually got across to the wider church? The answer to that question is complicated.

Many individuals were deeply affected by his message about True Spirituality and their lives changed as a result. But in the United States at least, what attracted the majority were his ventures into the apologetic arena not his teaching on the Christian life. Undoubtedly he helped to strengthen the intellectual convictions of many throughout the variety of evangelical constituencies across the States. This in turn enabled a new level of engagement academically and politically, for all of which he deserves our thanks and respect to this day.

But the church at large, even as it eulogised him for these new contributions, even going so far as to hail him at times as a prophet, in fact ignored his emphasis on spirituality. So radical was it that it remained practically invisible and unintelligible.

In large measure this helps to explain why Schaeffer's later and much misunderstood emphasis on social concerns, particularly his passionate loathing of abortion, were less carefully applied and nuanced than he himself would have wanted. For example, he repeatedly warned against the dangers of 'wrapping Christianity in the American flag' as he was wont to call it. But his warnings went unheeded and the result was that the larger community quickly identified him with what evangelicalism at large was doing and saying politically, dismissing him along with the rest as a right-wing fundamentalist, which he most certainly wasn't.

> His books continue to sell widely as do the documentaries he made on history and ethics.

What he was doing, in fact, was applying another of his familiar dicta; 'the Lordship of Christ over the whole of life'. Christianity, in other words, is not 'churchianity' – worship, evangelism, prayer meetings etc, good as these are – but reality, hence requiring engagement within all arenas of public life, business, culture, education, philanthropy, sport etc.

Schaeffer's acceptance in American evangelicalism was widespread and influential, though complicated as we've said. When he insisted on the development and application of the Christian mind he was well received and the church inestimably strengthened as a result. But things would have been better had his spiritual challenge been more widely understood. Instead what I call 'the virus of technique' continued to be the church's default mode across the board. Mega churches proliferated, marketing techniques were enthusiastically applied – neither to the church's advantage as writers like David Wells, Os Guinness and Craig Gay have well documented.

British evangelicalism by contrast managed to marginalise Schaeffer as quickly as possible. His biblical challenge to the idiosyncratic traditions of its varied constituencies was too threatening. Rather than let him prevail they chose to ignore him: the scientists found fault with his insistence on a real Adam & Eve and an actual literal 'fall'; the preachers didn't like his emphasis on discussion and persuasion – it was too intellectual, not sufficiently spiritual; the medics took umbrage at his 'hard-line' position on abortion and infanticide; the pietists wondered what good could come out of 'culture'; and the Anglicans, of course, disliked talk of 'pure' and 'impure' churches.

As a result Schaeffer is still a household name in Evangelical circles in the States while being almost unknown in the UK. Despite this his influence remains, much like C S Lewis's. His books continue to sell widely as do the documentaries he made on history and ethics, as do the writings of his wife, Edith, who is still alive. Younger leaders in South America and Asia are discovering his prophetic insights and finding them just what they need at the start of the 21st century. In addition L'Abri continues to exist and to flourish, though never, given its unusual calling, without difficulty and a certain 'hiddenness'. That, too, testifies to what he achieved. No greater testimony exists, however, concerning the reliability of his fundamental concerns, than his continuing relevance. This is the more remarkable given the phenomenal rate of change over the past half century. The continuing 'fragmentation' as he called it of western society in fact increases our respect. Did he not predict just this almost fifty years ago? Like any biblical prophet his message came in the starkest terms yet with profound sympathy and sincerity. Now we find ourselves living in the midst of what he portrayed. The more reason, then, to attend to what he said in the first place, especially in the area of his deepest concern, the actual moment-by-moment relationship with the Living Christ.

Would that he were still with us! ■

40 years of Creation Ministry in Britain[1]

David Tyler, Secretary of the Biblical Creation Society
Author of *"The Guide. Creation – Chance or Design?"*

40 years ago, most of the Christian community in Britain regarded Theistic Evolution, the belief that God created by a process of evolutionary transformation, as orthodoxy. Nearly all the literature available took this position, although alternatives could be found in books imported from the US. Creationism was not on the agenda for most Christian leaders.

However, God was working to change this situation. Sylvia Baker learned evolutionary theory from Professor John Maynard Smith, who came to be recognised as a world authority on the subject. She started her student life as an evolutionist, but came increasingly sceptical of claims about "overwhelming evidence". Later, whilst doing research in neurobiology for a Masters degree, she was asked to speak to her local church by the pastor, Harry Waite. The talks were to cover the history of the rise of evolutionism, the fossil evidence, the genetic evidence, the age of the Earth and the biblical approach to origins issues. Shortly afterwards, Bob Horn, then editor of *Evangelical Times,* printed them in monthly instalments: June – October 1975. The reader reaction was such that Evangelical Press published them in booklet form in April 1976, with the title: *"Bone of Contention – is evolution true?"* It captured the interest of both Christians and unbelievers, and it was not long before Sylvia was receiving communications from both categories of reader about the usefulness of this booklet. The third edition was published in 2002 and is still in print.

Returning to the 60s, we need to refer to developments within creationism in the US. A very significant book was published in 1961: *"The Genesis Flood"* by John Whitcomb and Henry Morris. This book stimulated a revival of creationism worldwide. It combined a powerful exposition of what Genesis actually teaches about the early Earth and the Flood with a critique of geological data offered as evidence for an old Earth. In 1969, Evangelical Press took the decision to publish the book in the UK. It was a turning point for creationism in Britain.

Opposition to evolution in the UK at that time was led by the Evolution Protest Movement. The history of this organisation goes back to 1932. The diversity of people participating made it easier for them to unite on opposition to Darwinism than to affirm what was actually believed by EPM leaders. The stimulus of what was going on around the world in creationism led the EPM Council to refocus their message and rebrand as the Creation Science Movement. CSM has continued to develop, under the chairmanship of Dr David Rosevear, as a publisher of leaflets about specific topics and a bimonthly journal. The biggest project CSM has undertaken has been the Creation Museum at Portsmouth, opened around 2000. This exposes visitors to evidence that challenges Darwinism and it affirms the Biblical record of history.

During the 1970s, there was a strong emphasis on "creation science", influenced by the development of the creationist agenda in the US. Often, what was lacking in the message was biblical thinking and biblical theology. An initiative was taken by some theological students in 1976. These students were linked to the InterVarsity Fellowship (now UCCF) and were very concerned about the way Theistic Evolutionists were handling the Bible. They formed the Biblical Creation Society to provide a broader platform to explore the issues in a scholarly way. The early years of BCS involved the leadership of Nigel M de S Cameron, whose doctoral studies underpinned the ethos of the Society. In 1983, Nigel's book was published, *"Evolution and the Authority of the Bible",* with a powerful section on the problem of evil. This was intended to be a major challenge to theistic evolutionists: if God is good, why did he choose to create using death, suffering and pain as part of the process? BCS publishes a quality journal *"Origins"* that has, over the years, provided an outlet for original scholarly work. For many years, John Peet has represented the Society in speaking and preaching, with regular ministry trips overseas.

The leadership role of Professor Edgar Andrews has been very important within the UK. In a series of publications, he presented his approach to these issues to the Christian public: *"From Nothing to Nature"* (1978), *"Is Evolution Scientific?"* (1979), *"God, Science and Evolution"* (1980), *"Christ and the Cosmos"* (1986). The first of these titles was written to help young people think through the science issues and to recognise the different ways the Bible informs our thinking. The other titles explored many science and faith themes. One of these concerned the distinction between "scientific creationism" and "biblical creationism", with the latter providing "a full and faithful picture of the cosmos and its Creator" (*Christ and the Cosmos,* p. 101).

It was on February 14 1986 that a momentous debate took place with the motion: "that the doctrine of Creation is more valid than the Theory of Evolution". Those affirming the motion were Prof Edgar Andrews and Dr A.E. Wilder-Smith. Opposing them were Dr Richard Dawkins and Prof John Maynard Smith. This was the Huxley Memorial Debate at the Oxford Union. The vote at the end of the debate was 150 ayes and 198 against, and was a creditable outcome for those proposing the motion. This experience appears to have left an indelible mark on Richard Dawkins. Ever since, he has made it a matter of policy not to enter into formal debates with people identified as creationists. He thinks that scientists should not participate in such debates because they have the effect of dignifying creationism as an intellectual position. Also, he is fond of repeating the claim that there are no accredited scientists who affirm creationism. However, the Oxford Union debate is sufficient refutation, because two highly respected scientists presented creditable critiques of evolutionary theory and affirmed creation. Furthermore, this debate forced Richard Dawkins into the position of having to debate evidences, which brings creationism into the province of science. It is only by refusing to respond to such evidence-based reasoning that Dawkins can maintain the façade that these issues are wholly outside science.

By 1988, the creationist community in the UK was maturing and new people were coming forward to write and speak. The number of creationist books in print had increased substantially and their scope was much broader. However, there was still a sense that the issue was an optional extra for most Christians. This led to the production of *The Creation Manifesto,* demonstrating to a wider community that the foundations of the Gospel and of all major Christian doctrines are to be found in the book of Genesis and the themes of creation. This *Manifesto,* published by BCS, was an attempt to find common ground among the different creation groups and to explain why biblical creation is central (rather than peripheral).

In 1992, BCS and CSM jointly hosted the European Creationist Congress in England, and CSM hosted the Congress again in 2000. This brought together creationists from many European countries to build the creation approach to origins and to strengthen relationships.

To encourage scholarly activity, BCS has three special interest groups: geology, biology and astronomy. There are many developments to be excited about: new thinking about the flood and understanding the pattern of fossils in the rocks; the concept of "basic types" in biology and implications for the Genesis "kinds"; etc.

In the 1990s, the Creation Science Foundation (based in Australia and the US) commenced working in the UK. Meetings involving Ken Ham and other people involved in this organisation (later rebranding as Answers in Genesis) were very successful in capturing media attention and bringing the creation message to people's attention. Since the full-time appointment of Dr Monty White in 2000, AiG-UK has seen steady expansion of its activities.

Nevertheless, by the close of the Millennium, it was apparent to many in the creationist community that most church leaders continued to regard the issue as secondary. Indeed, many still thought that the creationist emphasis on the historicity of Genesis was turning the clock back 100 years and reviving debates that were settled in the Victorian Age. It was apparent that the influence of Theistic Evolution was still holding sway in Britain. Thoughts along these lines led the Biblical Creation Society to make 2000 a strategy year with a process of consultation culminating in a retreat. The outcomes can be summarised as follows. (1) A major priority is to help people understand that creation themes are central to the Gospel message and foundational to developing a Christian mind on a great diversity of "current issues". (2) Opportunities for full-time creation ministries were increasing, and we need to pray for the right people and the right means for this to happen.

God is answering these prayers. In particular, Paul Garner was identified as someone with the calling and the gifts to exercise a full-time ministry. Extensive discussions took place regarding church-based and organisation-sponsored initiatives. Consequently, Biblical Creation Ministries was formed with significant support via collaborating churches as well as direct giving. Since October 2002, Paul has been speaking to an enormous range of listeners: public meetings, Sunday services, events for children and young people, men's and ladies' meetings, student groups and the media. At the same time, AiG-UK has been increasing its staffing, so that there are now several full-time people with a creation-based ministry.

Recent years have seen the impact being made by the Intelligent Design Movement. Under the leadership of Professor Phillip Johnson, ID has grasped numerous opportunities to show that science has been hi-jacked by materialists, with Darwinism as their key tool for promoting the fallacy that science has disproved purpose and design in the cosmos. ID scholars have responded by showing the weaknesses of Darwinism as theory, the reality of design in nature (being detectable by the tools of science) and also that the secularisation of Western culture has gone further than most of us think. Some creationists have welcomed ID as an answer to prayer, whereas others distance themselves from it because, they think, ID does not appeal to the Bible.

A new UK organisation appeared in 2006, Truth in Science, with Professor Andy McIntosh as the lead academic. This ministry has its focus on education and the need to break the stranglehold that materialism has on educational policy regarding science. The launch of Truth in Science was marked by the sending of DVDs with an ID message to all UK schools teaching science. The ensuing furore speaks for itself: with most media outlets carrying the story, with questions being asked in Parliament, with science organisations issuing statements and the internet buzzing!

There is a culture war in progress. At its most fundamental level, advocates of Theism are seeking to take on the advocates of Materialism. The fiercest battles are over origins and the status of Darwinism. However, one cannot understand the war without recognising its breadth. There are conflicts over the nature of science, the meaning of knowledge and truth, the relationship between science and faith, ethics and morality, life issues, sexual relationships and social structures, etc. Indeed, all the issues identified in *The Creation Manifesto* are being challenged. Creationists in the UK see themselves as foot-soldiers in this battle and covet the prayers of God's people and welcome all who want to enlist in active service! ■

Note

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[1] This article first appeared in *Evangelical Times* March 2007 and is used with permission.

Development of Resistance

Marc Surtees

Introduction

Evolution has been defined as a change with time. Therefore, it is often assumed that observed small changes are proof of the theory that all living things evolved from a common ancestor that lived billions of years ago. Two biological phenomena that are often claimed to provide examples of "evolution in action" are antibiotic resistance and warfarin resistance.

Antibiotic Resistance

Antibiotics are chemicals that can prevent bacterial growth or kill bacteria. They work through several different means. Some inhibit the synthesis (or production) of bacterial cell walls; some inhibit the synthesis of proteins; still others inhibit the replication of bacterial DNA. All of these are, of course, detrimental to the bacteria that encounter the antibiotic. So detrimental, in fact, it often kills them.

However not all bacteria are susceptible to antibiotics. Some resistant bacteria inactivate the antibiotic by destroying or modifying the drug itself so that it is no longer toxic. Some resistant bacteria pump the drug out of the bacterial cell so that the concentration of the drug is too low to be effective. Still, other resistant species have an altered form of the target site of the drug (the place on the cell where the drug binds), so the antibiotic cannot "find" its target.

There are two mechanisms by which bacteria can become resistant to antibiotics; mutation and acquisition of resistance genes by conjugation and or transposition (transformation and transduction).

Mutations

Bacteria reproduce by simple division but before this can occur the DNA inside the bacteria has to be copied. Sometimes errors can occur during the copying process and the result is a mutation. These mutations are usually harmful and the mutated bacteria will probably die or reproduce much more slowly that the normal type. However sometimes a mutation occurs that will allow the bacteria to resist the effects of the antibiotic. These resistance characters are often simple mutations (i.e. changes in a single gene) that result in the production of a modified target. The result is that resistant bacteria are slightly different from their susceptible ancestors.

> Evolution has been defined as a change with time. Therefore, it is often assumed that observed small changes are proof of the theory that all living things evolved from a common ancestor that lived billions of years ago.
>
> “

So what happens if a bacterial cell has a mutation that allows it to resist the effect of an antibiotic? If that bacterium is in the presence of the antibiotic, then it will have an advantage: the drug will not kill it! It will be able to reproduce, while the susceptible bacteria (which are inhibited or killed by the antibiotic) will not. In the presence of the antibiotic, the resistant mutant has a selective (reproductive) advantage over normal cells.

Originally, most or all bacteria in the population would be susceptible to the antibiotic. Over many generations, the resistant type will make up a greater and greater percentage of the population. If the bacteria are growing in the presence of an antibiotic, most or all of the individuals in the bacterial population will be resistant to the antibiotic. The population has evolved resistance due to natural selection by antibiotics: the genetic structure of the population has changed, from susceptible to the antibiotic to resistant to the antibiotic. This process is completely reversible and if the antibiotic is removed then the numbers of resistant bacteria will decline and eventually the great majority will be susceptible to the antibiotic.

Conjugation and Transposition

There are genes that code for enzymes that destroy antibiotics and if the bacteria have these genes higher concentrations of antibiotic or longer treatment is necessary to kill the bacteria. Bacteria that do not have these genes can acquire them through one of two mechanisms that involve the exchange of genetic material.

Conjugation

Bacterial cells can join and exchange of genetic material in the process of conjugation. Inside many bacteria there is a somewhat circular piece of self-replicating DNA known as a plasmid, which codes for enzymes necessary for the bacteria's survival. Certain of these enzymes, coincidentally, assist in the breakdown of antibiotics, thus making the bacteria resistant to antibiotics. During conjugation, plasmids in one organism that are responsible for resistance to antibiotics may be transferred to an organism that previously did not possess such resistance.

Transformation and Transduction

In transformation, DNA from the environment (perhaps from the death of another bacterium) is absorbed into the bacterial cell. In transduction, a piece of DNA is transported into the cell by a virus. As a result of incorporating new genetic material, an organism can become resistant to antibiotics.

Warfarin Resistance

Warfarin is a substance that stops blood coagulation and is used to prevent strokes and heart attacks. Given in sufficient amounts warfarin will cause animals to bleed to death. For this reason is has been used as a poison to eliminate rats and mice. Warfarin works by binding to and interfering with the activity of an enzyme that produces some of the clotting factors that are essential for blood clotting.

When warfarin has been used as a rat poison it has been found that some rats are resistant. The more warfarin is used the more common resistant rats become. In rare cases, warfarin has been found not to work in some people who are given it for medical reasons.

The mechanism of warfarin resistance has been investigated in humans and rodents. It is has been found that there are two possible mechanisms of warfarin resistance; increased metabolism and reduced receptor binding affinity.

Metabolism

As with all drugs there are enzymes that break down or metabolises warfarin. The activity of these enzymes varies from person to person. This natural variation in the enzyme activity means that people with a more efficient enzyme will get rid of the warfarin faster and prevent it from having an anticoagulant effect. In rats the animals with the more efficient enzymes break down the warfarin more quickly and will be less likely to be poisoned.

Receptor Binding

This is also the case for the enzyme that warfarin binds to. Individuals have slight differences in the enzymes they possess and some have a lower affinity for warfarin. These individuals will continue to produce clotting factors and will therefore be resistant to warfarin.

> This is Darwinian natural selection and shows that populations can adapt to changing conditions because of the nature of genetic information systems.

Discussion and Conclusions

Most types of antibiotic resistance were already in existence before antibiotics were discovered and used extensively to treat infectious diseases. In these cases the resistance has not occurred since antibiotics became common but rather the resistance genes that were already present have been selected for, and have therefore become more common. Similarly mutations that modify the target sites arise at a low frequency and in the presence of antibiotics, bacteria carrying these mutations can become more common. The same is true for warfarin resistance. There are always a few rare individuals who are resistant and these are selected for and become more common if warfarin is used.

However, none of the processes involved is strictly 'evolution' in the popular sense. This is Darwinian natural selection and shows that populations can adapt to changing conditions because of the nature of genetic information systems.

These changes in frequency of certain genes in a population have not resulted in the production of new species, even though enough time has elapsed for quite dramatic changes to be observed in bacteria. Assuming a conservative estimate of one hour for each "generation" of bacteria then, since the introduction of antibiotics, 500 000 generations have been produced. This is equivalent to about 10 million years for humans, during which time people have supposedly evolved from primate ancestors. Yet the antibiotic resistant bacteria are still the same species.

Both antibiotic resistance in bacteria and warfarin resistance in rodents provide examples of selection that occurs due to a change in the environment. Study of these phenomena shows us the nature and extent of the effects of differential survival. The increase in frequency of resistance is a good example of Darwinian natural selection. It should also be noted that this mechanism is limited to the selection of existing variations or novel variations that arise by some other process. Furthermore, these observations do not provide any support for the theory that new kinds of plants or animals can arise by the processes of random variation and natural selection. ■

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Evidence for the Evolution of Bats

Jerry Bergman, PhD

Abstract

The evidence for bat evolution was reviewed, focusing on both the fossil record and the recent molecular biology research. All of the earliest fossil bats so far discovered are fully modern bats, and no viable links have been discovered to support bat evolution from its putative non-bat ancestors. Unconstrained by a fossil record, many conflicting theories exist about bat origins and divergence. The evolution of bat flight and echolocation was also reviewed, concluding that no evidence exists for the evolution of either innovation.

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Introduction

On a warm summer evening in many areas of the country, what first appear to be birds flying around are often actually bats – as indicated by their erratic darting flight. Bats are unique, highly beneficial, fur covered creatures. This unusual animal has been classified as a bird, even a rodent and, by Linnaeus in 1748, as a primate. Bats are not birds but mammals placed in their own separate order Chiroptera, Greek for "hand-wing" because the bats "wings" are flat sheets of tissue connected to their hands. They are classified as mammals because the females nurse their pups with nipples located on their sides under their wings. The bat's body, but not its "wings," is covered with hair as are most all mammals (Graham, 1994). Bats are also the only mammals that have the ability to fly on their own power, and most kinds of bats use a complex echolocation (sonar) system to locate their prey and navigate around in their world of darkness (Simmons, 2005, p. 527).

Fully one in five mammals living on Earth today is a bat – the only mammal kind with more species are rodents (Sears, *et al.*, 2006, p. 6581). Bats exist in an extraordinary diversity of lifestyles and morphologies. They are found in abundance in warm latitudes, live on every continent except Antarctica, and thrive everywhere except where it is extremely hot or cold (Simmons, 2005). Depending on the specie, they subsist on a diet of insects, nectar, pollen, fruit, small vertebrates, fish, blood, and nuts (Carroll, 1998, p. 278). Their cranial morphology and dentition is very specialized to fit their diet. They play a critical role in the ecosystem as dispersers of seeds, pollinators of flowers, and insect predators. Some types, such as fruit bats, are very common, other kinds, such as insectivorous sacwinged bats, are very rare (Greenhall, 1965).

The over 1,000 known bat species are currently all classified in 18 living and six extinct families (Simmons, 2005, p. 527). All bats are divided into two suborders, megabats (megachiroptera) and microbats (microchiroptera). Megabats are large, mostly non-echolocating fruit-eating or nectar drinking bats, that live in the tropics and usually fly during the day (Fleming, 1985). They are found only in the Old World, mostly in the tropics of Asia, Africa, and Australia. The largest megabat, the flying fox, has a wingspan approximately two meters across. The microbats are very diverse and widely distributed small-sized bats. Most are echolocating (the only microbat exception is the Rousettus) and most are insect eating night-flying bats (Williams and Mies, 1996, p. 4). The smallest microbat is about the size of a bumblebee and the weight of a dime.

Evolution of Bats

Darwin, in his chapter on the difficulties of evolution, cited bats as his first example, asking "is it possible that an animal having, for instance, the structure and habits of a bat, could have been formed by the modification of some animal with wholly different habits?" (1859, p. 171). He added that it would require a "long list" of animals that had clear transitional forms to "lesson the difficulty in any particular case like that of the bat" (1859, p. 180). Naturalists still face the same problem today. Thewissen and Babcock conclude that the "origin and early evolution of bats is among the greatest controversies in modern" biology because the "fossil evidence for bat origins is extremely sparse" (1992, p. 340).

Actually, many excellent well-preserved fossils of bats exist dating all the way back to the Eocene. The problem is that none of the existing fossils support bat evolution. As a result, many theories of bat evolution exist. One theory is that bats first evolved in Laurasia, possibly in North America, from a small placental mammal (Teeling, *et al.*, 2005; Carroll, 1998, p. 277). This view is controversial for many reasons. In fact, because it is unconstrained by fossil evidence for evolution, the whole evolutionary history of bats "has been obscured by controversial phylogenetic hypothesis" (Teeling, *et al.*, 2005, p. 581).

A common argument is, because the bones in a bat's wing are very similar to a mammal hand bones, bats must have evolved from some shrew-like animal that could glide from tree to tree like flying squirrels (Williams and Mies, 1996, p. 2). Sears, *et al.*, wrote that the current general consensus is that the common ancestor of bats was a small quadripedal mammal with a limb morphology that was similar to that of mice" (2006, p. 6581). They were not more specific. A leading bat fossil expert, Carroll, concluded that "the fossil record does not provide evidence of the transition" from "small placental mammals" to bats (1998, p. 277).

Others argue from anatomical evidence that bats evolved from primates, flying lemurs, or even tree shrews (Lin and Penny, 2001). Another claim is bats and Phenacolemers, a flightless mouse sized animal, share a common ancestor with bats (Hamrick, *et al.*, 1999). It is even proposed, based on neuroanatomy, that "megabats are more closely related to primates than to microbats" (Lin and Penny, 2001, p. 684). Evidence for the evolution of the 1,000 known bat species is also absent. Bats, like dogs, have an enormous innate genetic ability to produce variety, but, like dogs, clear genetic limits exist.

Yet still others conclude, based on molecular evidence, that bats are more closely related to cetferungulates and not primates (Lin and Penny, 2001, p. 687). Teeling concluded, based on molecular evidence, that "living bats last shared a common ancestor at or just after the Cretaceous-Tertiary boundary" (Simmons, 2005, p. 527). University of Chicago biologist Van Valen wrote 25 years ago that we can hypothesize about how bats originated, but "it is harder to go beyond this. Bats have no Archaeopteryx as yet" (1979, p. 103). He then speculates on the possible evolutionary histories of bats, stressing the tentative nature and problems with existing speculations. His conclusions are still valid today.

Darwinists' major explanation for the lack of evidence for bat evolution is that bats are not common in the fossil record partly because they have small, light skeletons that do not preserve well. Actually the earliest-known bats are represented by excellent fossil material, including virtually complete skeletons of *Icaronycteris index* from the early Eocene (50 Myr BP) of western Wyoming and *Palaeochiropteryx tupaiodon* from the middle Eocene (45 Myr BP) 'Grube Messel' of western Germany (Novacek, 1985, p. 140).

The *I index* appears to be a fully modern bat. Enough excellent examples exist to determine that the present evidence does not support the evolution of bats from any lower animal form. Unusually complete bat fossils dating all the way back to the Eocene have been found in locations that range from the Green River formation in Wyoming to the Messel Shale in Germany (Carroll, 1988). So far, all of the fossils found in these sites are modern-looking microchiropterans.

Perkins concluded that the oldest fossil bats, which have been dated by evolutionists at around 54 million years, are not "dramatically different from living bats" but rather, in most ways, are indistinguishable from modern bats (2005, p. 314). Burton describes the Eocene fossils "as fully evolved and structurally adapted for flight as any recent forms" (Burton, 1980, p. 494). Carroll adds that the skeletons of "early Eocene species are almost indistinguishable from modern forms" (1988, p. 278).

Older fossils that may reveal insight into bat evolution from non-bats have not yet been found – and the earliest bats existing in the fossil record are all clearly bats. For this reason, despite their large number today – they make up more than 20 percent of all extant mammals – "their evolutionary history is largely unknown" (Teeling, *et al.*, 2005, p. 580). Lin and Penny add that not only is the evolutionary history of chiroptera uncertain but "even the monophyly of this group has been questioned" (2001, p. 684).

The story of the evolution of each bat type is the same. For example, Fenton notes that although protein comparisons "suggest vampire bats evolved more than 10 million years ago" the "fossil record sheds no light on the evolutionary origin of vampire bats" (1998, pp. 94–95). Fenton then outlines his theory of vampire bat evolution which, he stresses, "is just that – a theory. Now we wait to see who comes up with a better one" (1998, p. 97). The same problem is true of all other bat types.

Evolution of Flight in Bats

It is believed that flight in higher animals evolved only three times in all of history, once in pterosaurs, once in birds, and once in bats (Carroll, 1998, p. 277). This is a concern to evolutionists because "bats' evolutionary success is in large part" due to "their power of flight" (Wimsatt, 1957, p. 106). Because the evolution of flight is recognized as very improbable, a single origin of flight in mammals is postulated (Teeling, 2005, p. 581). Although all bats are capable of true powered flight, some can glide like raptors (Williams and Mies, 1996, p. 2). It is for this, and other reasons, why "some workers believe that flying foxes, which are actually Old World fruit-eating bats, are more closely related to humans and other primates than to the small bats that Americans see flying overhead" (Thewissen and Babcock, 1992, p. 340). Specifically, they argue that lemurs are ancestral to fruit bats.

Bat "wings" are designed so radically different than bird wings that they are technically not even called wings by bat biologists, but rather "alar membranes." Hence, Darwin wrote "the bat's wing is a most abnormal structure (1859, p. 150). Some of the ways that a bat "wing" is different than a bird wing include a bird wing is a highly specialized organ dedicated to the task of flying. The bat "wing" is a thin skin membrane stretched over very elongated "fingers" (see figure 1). As shown in figure 2 the bones that support four of these "fingers" are similar to greatly elongated phalanges of mammals (Seeley, 1967, p. 24). The long-bones used in the bat wing have the unique feature of being designed similar to an "I-beam" to achieve strength and light weight.

Otherwise, the "wing" bones of a bat resemble those in an arm and a human hand. Consequently, bats have been placed in class Mammalia, order Chiroptera, which literally means "hand-wing." The legs of bats are also part of the wing membranes and cannot be effectively used separately. The alar membrane stretches from the third finger, which in bats is disproportionately long, to the foot, and then to the tail, quite in contrast to the design of bird wings (see figure 2). In birds, feathers are attached to the wing along a limb called a wing proper.

The bat flight system varies greatly in different bat types, as it also does in birds. Bats do not have one alar membrane type but rather a family of alar membranes, just as birds have a family of wing types. The alar membrane is clothed with short hairs as is also the bat's body (Seeley, 1967, p. 24). Most bats can fold their elongated digits together like a folding hand fan so they can be carried at the sides of the body as they walk on land. The fifth, more normal sized digit, terminates in a claw that can be used for walking (Seeley, 1967, p. 24). The wing claw can also function to catch its prey and transfer it to the bat's mouth while in flight. Bats do this so effectively that they can locate, pursue, catch, and eat two insects within a second by this means (Griffin, *et al.*, 1960).

Flight lift in bats is provided by the "wing" downstroke, but also by changing the wing curvature and the downstroke angle (Graham, 1994, p. 16). Bats have highly sensitive receptor cells on their "wings" that provide them with constant feedback to allow them to instantly adjust their wings according to changing flight conditions. These receptors use Merkel cells, a touch sensitive cell common on the skin of most mammals and even humans. Bats also have fine hairs extending out from their Merkel cells to accurately sense the air flow traveling across their wings. The Merkel cell feedback is used to adjust various wing traits, such as wing curvature. If the wing is curved too much or too little, lift will be lost, causing a stall and, if not adjusted soon enough, the bat will fall to the ground. The wing position also must be adjusted. It is now known that effective flight is not possible without this entire irreducibly complex system, of which we have described only a few of the basic components.

The fossil record shows no evidence for the evolution of bat flight – nor any evidence of the evolution of any other kind of animal flight for that matter (Bergman, 2003). Rather, the "earliest known members of these [bat] groups had … advanced flight apparatus" (Carroll, 1998, p. 277). Sears, *et al.*, concluded that the "earliest fossil bats resemble their modern counterparts in possessing greatly elongated digits to support the wing membrane, which is an anatomical hallmark of powered flight" (2006, p. 6581).

Their study found that the length of the primary supportive elements of the bat wing "have remained constant relative to the body size over the last 50 million years." They add that the "absence of transitional forms in the fossil record led us to look elsewhere to understand bat wing evolution" (2006, p. 6581). Hecht concluded that "the origins of bats have been a puzzle. Even the earliest bat fossils, from about 50 million years ago, have wings that closely resemble those of modern bats" (1998, p. 14).

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Unconstrained by empirical evidence for bat flight evolution, researchers are free to develop various theories. One current theory of bat flight evolution is that, first, a shrew-like mammal evolved membranes that connected their limbs and tail, which allowed the animal to glide. The next step in bat flight evolution was postulated to be movable proto-wings, then the membranes became thinner and four of the phalanges gradually became longer. The last step was the evolution from a fixed wing to the modern movable and highly controllable wing (for an illustration of this process, see Graham, 1994, pp. 10–11).

These just-so stories are not supported by either molecular or fossil evidence. Nor are they supported by a mechanical evaluation – the flight system must function to aid survival and, until it is functional, a bat would not be able to fly or even glide, nor could it survive very well as a terrestrial animal because the wing membranes would severely interfere with any effective ground locomotion that it might attempt.

Some have theorized that flight evolved independently in megachiroptera and microchiroptera. Others disagree with this view. Van Valen notes that, although major differences in megabat and microbat flight systems exist, all "major external adaptations for flight are the same in these two groups, and almost all differ from those of other flying animals" (1979, p. 103). Even more important, Van Valen adds, is the fact that the "earliest fossils of bats do not provide evidence for this view."

Evolution of Sonar in Bats – Seeing with Ears

Another major unresolved problem is the evolution of sonar, a complex echolocation system used by a wide variety of animals from many bats to a handful of birds plus whales, dolphins, and porpoises (Perkins, 2005, p. 314; Au, 2004; Graham, 1994, p. 11). The complex sonar system is a critically important reason why bats have achieved their enormous numerical and ecological niche success today. Sonar echolocation is now known to be a "complex system involving specialization of the respiratory system, ear and brain" (Simmons, 2005, p. 527). This is illustrated by the fact that those bats that often fly in large swarms must ignore the echoes of their companions and the "multiplicity of odd reverberations of sound from the irregular facets of the walls and ceiling" in the caves in which many live (Novick, 1970, p. 32).

Much is known about echolocation, but scientists disagree on even the most broad outlines about how it could, or did, evolve (Denzinger *et al.* 2004; Simmons and Stein, 1980; Springer, *et al.*, 2001). Because the basic animal groups that use echolocation are all believed to have evolved independently, some argue that sonar also must have "evolved independently among widely disparate groups of creatures" (Perkins, 2005, p. 314). It is generally agreed that it is very unlikely sonar evolved even once, and to postulate that it evolved numerous times strains the credibility of many researchers. The problem with all theories of sonar evolution is that the fossil record "shows a sophisticated sonar system was present in the earliest records of microchiropteran history" (Novacek, 1985, p. 140).

The sound used for echolocation is produced by a thin vocal membrane especially designed to produce echolocation calls. The sound is usually emitted through the mouth, but some bats use a "nose leaf," a complex nose structure, to produce the sound for sonar. Sonar systems produce sound waves between 20 and 80 KHz, which is just outside the range of normal human hearing (20 to 20,000 Hz). The sound that bounces off objects is reflected back to the bat. The echo is received by the bat's large funnel-shaped ears designed to effectively pick-up the sound reflection. The bat's transducer system then calculates the location of the object by determining the delay between emission of the sound and the return of its echo. This allows for accurate navigation in total darkness. Most bats have excellent vision, and, all at the least have functional eyes – echolocation helps them to live nocturnally and in caves or other dark places, such as house attics (Graham, 1994, p. 6). Some bats, such as flying foxes, use their excellent vision for most of their activities.

Evolution of the Guided Missile Strategy to Capture Prey

Bats usually capture their prey in flight (Wimsatt, 1957, p. 108). As noted, bats use sound rather than sight to track prey by emitting a series of ultrasonic pulses to evaluate their environment. When the pulses hit an insect, they bounce back to inform the bat of the insect's location. Insects move both very rapidly and very erratically, as anyone who has tried to swat a fly or mosquito knows, requiring a

Fruit Bat © Michael Pettigrew, iStockphoto (2060619) highly effective echolocation system to be effective. The main system used in bats, laryngeal echolocation, is "one of the most innovative features in the evolutionary history of mammals." This system is often accurate enough to detect a single fine hair (Springer, *et al.*, 2001, p. 6241). The echolocating strategy that bats use to track and catch erratically moving insects is similar to the system used by guided missiles to intercept evasive targets. It is also very different from the system that humans and many animals use to track moving objects.

A research team used infrared video and sound recordings of bats intercepting both free flying and tethered insects to reconstruct the bats' flight and its tracking maneuvers. By this means they determined that bats do not use the constant bearing method that baseball players use. Instead, bats constantly change their flight and speed in response to the insect's rapid movements. The bat locks on to its target and keeps its compass direction to the target constant, changing its flight direction to achieve this. This strategy is termed parallel navigation after the parallel trace for the bearing lines. In the 1940s, engineers working on the problem of programing guided missiles to destroy their targets developed a very similar technique (Ghose, *et al.*, 2006, p. 865). The bat's strategy for catching erratically moving targets such as insects is called the time-optimal method.

The system humans and many animals use is to sight the target, then move at a fixed speed in a straight line with constant bearing toward the target. Constant bearing keeps the person focused on a moving target, such as a baseball that moves in a highly predictable fashion, and allows him to move in a straight line to close in on the target (Ghose *et al.*, 2006, p. 865). His eyesight then tracks the ball's movement to enable him to move in on a collision course with the ball.

As noted, insects don't move in a predictable straight trajectory like baseballs, but dart about erratically, and may be in the open air for only seconds at a time. For this reason, bats must work out in advance the path needed to catch an insect, not where it is now but where the insect is projected to be in the future. After the bat calculates where the insect will end up in a second or so, it must adjust its flight path accordingly.

Adaptive behaviors, such as agile flight and head-aim control, and adjustments in the timing patterns of sonar vocalizations, are all finely coordinated to allow the bat to effectively capture free-flying insects even in complete darkness. Bats require this system because both they and their prey move in all three dimensions, whereas terrestrial life usually moves in only two dimensions, making their movement far more predictable.

Other bats, such as certain megabats, use a very different type of echolocation based on tongue-clicks instead of vocal cords. This fact has always caused problems for Darwinism – did the two echolocation types evolve separately, or did one type only evolve first, and then diverge later into the two distinct echolocation types? The two systems are so different that many researchers argue sonar evolved independently several times in bats alone. A competing view is that echolocation evolved in the bat's common ancestor but was lost during megabat evolution, and some bats evolved the new tongue-click system, a very different – and evidently inferior – form of echolocation (Springer, *et al.*, 2001).

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A major problem for Darwinism is, if laryngeal echolocation is so critical to bat's success, why would it be "lost" and then replaced with an inferior system? In addition, why is any type of echolocation rare in animals, and why has it not evolved in many more animal types (Speakman and Racey, 1991)? Furthermore, why has it evolved so infrequently especially among birds and megachiroptera? Was it lost or never evolved in this class of bats? When it exists in bats, why is it used primarily for gross navigation in sighted animals rather then for prey detection, an area in which it is obviously very useful (Speakman and Racey, 1991)? The largest bats, including old world fruit bats, do not have sonar (Griffin, 1958, p. 41).

Another problem is megabats have a very different complex of nerves than microbats. The megabat system is in many ways more similar to primates (Pettigrew, 1986). For this reason, some argue that the common belief that all bats evolved from a common ancestor is wrong. Rather megabat's nervous system either evolved from primates, or evolved to be very similar to primates by parallel evolution. Since the later is unlikely, some biologists argue that megabats did evolve from primates, and are living primates. This does not solve the problem because then the very bat like megabat wing must have evolved by parallel evolution.

The Molecular Evidence

Because of its complexity, it is commonly assumed by many researchers that bat echolocation could have "evolved only once in bats" (Simmons, 2005, p. 527). Teeling, *et al.*, reviewed the molecular evidence to determine if "multiple origins of laryngeal echolocation within bats or a single origin of echolocation with subsequent loss in megabats" better fits the evidence (2005, p. 581). The molecular data suggests that microbat evolution was paraphyletic, but molecular data has not resolved whether laryngeal echolocation evolved independently in different microbats lineages or if it evolved in the common ancestor of bats and was subsequently lost in megabats (Springer, *et al.*, 2001, p. 6241).

Biochemical analysis of DNA data has also challenged the existing theories of bat evolution, requiring "a complete rethinking of our understanding of the evolutionary history of bats, including new evolutionary explanations for the more than 20 different anatomical specializations shared by living echolocating bats" (Simmons, 2005, p. 527). Once thought to belong to the same group as primates, bats are now classified in the super-order Pegasoferae along with cats, cows, horses, hedgehog and even whales. One study concluded that within this super-order bats are more closely related to horses than cows are (Okada, 2006).

Conclusions

The existing bat fossil record provides no evidence for bat evolution from a lower, non-flying form of life. The bat fossil record, although not as large as that for many other life forms, is dated by evolutionists back to around 54 million years ago. Bats appear abruptly in the fossil record as fully formed bats, motivating Van Valen to conclude that "although the time bats became bats can't yet be specified, their early evolution was undoubtedly rapid" (1979, p. 110). The oldest known complete fossil bat is a Icaronycteris dated by NeoDarwinists back to the Eocene, over 50 million years ago. Since then their evolution has been "near stagnation" (Van Valen, 1979, p. 110).

A total lack of any evidence for the evolution of bat flight and the evolution of two distinct types of echolocation are also major impediments to accepting the Darwinism explanation of bat origins. New fossils have supported this conclusion, and it is unlikely that more discoveries will alter it. Nor does the molecular evidence provide support for the existing theories of bat evolution. ■

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Skeletal Muscle and the Maximum Life-Span of Men

Hans Degens

Ageing is a well-known phenomenon in nature and is accompanied by a decline in bodily functions, ultimately resulting in death. Skeletal muscle is no exception and muscle weakness is a common problem in elderly people, leading to problems with normal activities of daily living and increasing the chance of falling and bone fractures.

Skeletal muscle is a remarkable tissue. It has an enormous capacity to adapt to increased demands; think about the huge muscles of body builders. Also the architecture of the muscle is marvellously designed, whereby filaments sliding along each other cause the muscle to produce force and to shorten at the same time, making movement possible. In addition, there are several control steps that regulate the amount of force that the muscle produces, such as a regulated recruitment of an adequate number of muscle cells and regulation of the intensity of recruitment of groups of muscle cells to obtain the required shortening and force for the intended movement. It is this fine control that allows us to make tightly controlled movements.

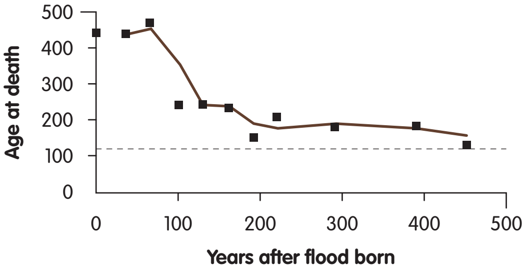
Although adequate muscle function is a pre-requisite for a high quality of life, skeletal muscle is not considered a vital tissue. While failure of the heart or brain is life-threatening, this can not be said about skeletal muscle. Yet, if the muscular system is unable to generate power, movement and more importantly, breathing, will be impossible and life will come quickly to an end. Indeed, excessive muscle wasting is life-threatening and is a sign of poor prognosis during many diseases, such as cancer, chronic heart failure and chronic obstructive pulmonary disease.

Both antibiotic resistance in bacteria and warfarin resistance in rodents provide examples of selection that occurs due to a change in the environment. Study of these phenomena shows us the nature and extent of the effects of differential survival. The increase in frequency of resistance is a good example of Darwinian natural selection. It should also be noted that this mechanism is limited to the selection of existing variations or novel variations that arise by some other process. Furthermore, these observations do not provide any support for the theory that new kinds of plants or animals can arise by the processes of random variation and natural selection.

In order to jump, one needs to recruit his/her muscles. The larger the power the muscles in the leg can generate per kg body weight the higher a person can jump and it is thus no surprise that muscle function is an important determinant of jumping performance. In a large population of men and women there appeared to be a linear decrease in jumping power between 18 and 88 years. This would not have been so remarkable were it not that if this linear relation is extrapolated to higher ages it appears that the jumping power is reduced to 0 at the age of approximately 130 years in both men and women (Runge *et al,* 2004).

The Decrease in Life-Expectancy Following the Flood

Indicated in the first column is the name of the person, the second column the year after the flood he was born and in the third column the age at which he died. The same data are plotted in the graph, where the dotted line indicates 120 years. The data suggests that after the flood the life-expectancy decreased to a little above 120 years. Most data are from Gen 11.



Name	Years after flood born	Age at death
Arpachsad	2	438
Selah	37	433
Heber	67	464
Peleg	101	239
Rehu	131	239
Serug	163	230
Nahor	193	148
Terah	222	205
Abram	292	175
Isaac	392	180
Jacob	452	127

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> Although Gen 6:3 may not necessarily have the maximal post-flood life-expectancy of men in mind, as several people after the flood reached a significantly higher age, it is tantalisingly close to what is written in this scripture.

Although this extrapolation should be interpreted with some caution, it predicts that the maximal life-expectancy, based on muscle power, is less than 130 years as life will cease to continue as soon as the power generating capacity of the muscles is below a certain threshold. Although reduction in physical activity will result in muscle atrophy and weakening, as everybody who has been hospitalised for some time will have experienced, this decline in muscle power is not solely attributable to a lower physical activity level at old age (Degens and Alway, 2006). Indeed, even in master athletes who have maintained a high level of physical activity the reduction in power generating capacity is evident, and also converges with normal people to zero power at approximately the age of 130 years (Grassi *et al*, 1991). These observations hint to a maximal life-expectancy of 130 years. Although Gen 6:3 may not necessarily have the maximal post-flood life-expectancy of men in mind, as several people after the flood reached a significantly higher age, it is tantalisingly close to what is written in this scripture: *'His days will be hundred and twenty years'.* ■

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Did Humans Evolve from Apes?

Marc Surtees

Introduction

Do the fossils of ape-like creatures that we find in our museums and see described in news stories and books on evolution prove that humans evolved from ape -like ancestors?

In this article we will look at some of the evidence to see just how strong it is, starting by a brief review of the more important fossils which are considered to be human ancestors:

- **Genus *Ardipithecus* (possibly two or three species)**
- **Genus *Australopithecus* (at least three species)**
- **Genus *Homo* (at least 5 species and possibly as many as 9 species). This group includes modern humans *(Homo sapiens).* I will discuss only three of the fossil species; *Homo habilis, Homo erectus* and *Homo floresiensis.***

There is no general agreement among evolutionists on which species was the ancestor of modern humans, although it is suggested by some that one of the *Australopithecus* species was the last common ancestor. The current consensus appears to be that *H. sapiens* evolved from *H. erectus* and that *H. erectus* is descended from *H. habilis.*

The Fossils

Ardipithecus

These creatures were ape-like animals about the size of a modern chimpanzee. They are believed to be the ancestors of the *Australopithecines.* The remains are rather fragmentary, but some claim that there is enough evidence to support the idea that they were bipedal (walking on two feet).

Australopithecus

The best known *Australopithecus* species is *A. afarensis* for which there are a relatively large number of samples. This species is accepted by many researchers as the most likely candidate for a human ancestor. Possibly the best-known specimen of A. afarensis is AL 288-1 ("Lucy"), found in 1974 at Hadar, Ethiopia (Johanson and Taieb, 1976).

These creatures display an intriguing mix of characters. They appear to be designed to move in three different ways. The structure of the fingers and feet suggests that they were adept at climbing trees. They also had wrists and fingers which are consistent with knuckle-walking just like today's great apes. The structure of the pelvis suggests that they would have been able to walk upright.

Laetoli footprints

The Laetoli footprints are very important because they were made by a creature which walked upright, supposedly over 3 million years ago. The footprints show that whoever made them had a human-like foot arch (Leakey and Hay, 1979) and one reconstructed *A. afarensis* foot has just such an arch. However, Harcourt-Smith and Hilton claim that the reconstruction is actually based on a patchwork of bones from 3.2-million-year-old *afarensis* and 1.8-million-year-old *H. habilis.* Furthermore, one of the bones used to determine whether the foot was in fact arched (the navicular) is from *H. habilis,* not *A. afarensis* (Wong, 2007).

The researchers first compared the gaits of modern humans walking on sand with two sets of the fossil tracks. This analysis confirmed that the ancient footprints were left by individuals who had a striding bipedal gait very much like that of people today. The team also examined naviculars of *A. afarensis, H. habilis,* chimpanzees and gorillas. The dimensions of the *H. habilis* navicular fell within the modern human range. In contrast, the *A. afarensis* bone resembled that of the flat-footed apes, making it improbable that its foot had an arch like our own. As such, the researchers report, *A. afarensis* almost certainly did not walk like us or, by extension, like the hominids at Laetoli.

Homo habilis

The most definitive statement one can make about *H. habilis* is that it is very difficult to define this species accurately. Indeed it has been said that the species is a mishmash of traits and specimens, whose composition depends upon which researcher one asks. Some specimens are very like the *Australopithecines* while others are very like *H. erectus.* Brain size varies from about 600 to 800 ml. A foot attributed to this species is essentially human. Another specimen has hand bones that would have given it a human-like precision grip. A recent paper by Spoor *et al* (2007) provides information that helps to define *H. habilis,* but also suggests that *H. habilis* and *H. erectus* actually lived at the same time and it is very unlikely that erectus evolved from habilis.

Homo erectus

This species was first described in the late 1800s as *Pithecanthropus erectus* and has since been renamed *Homo erectus.* They had limbs of human proportions and a brain volume of about 900ml which is just outside the lower limit for modern humans.

One of the most complete skeletons (KNM-WT 15000) of this species was found in Kenya in 1984 (Brown *et al,* 1985). It was described as being very similar to modern humans but with enough differences to justify the original designation as a separate species. However, recently described fossils have complicated the picture by suggesting that some specimens of *H. erectus* were more similar to *H. habilis* than previously thought and in some respects similar to australopiths (Lordkipanidze *et al,* 2007).

Homo floresiensis

H. floresiensis (which has been called the hobbit, because of its small size) was a small creature of about one metre in height with a brain volume of about 380ml (Brown *et al,* 2004). This species, if it is truly human, would indicate that genus *Homo* was much more varied in terms of shape and size and probably lifestyle than previously believed. However, it does not really constitute evidence for the evolution of humans from apes, as it was in existence at the same time as *H. sapiens.*

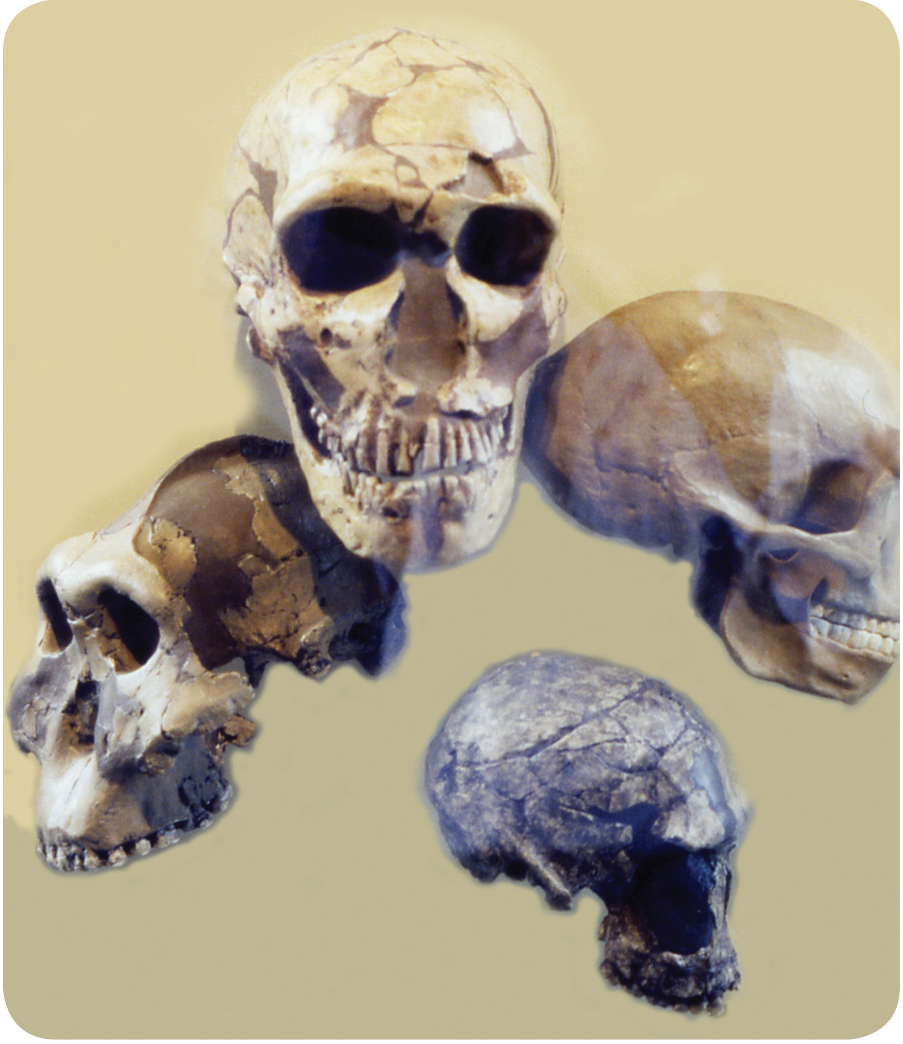
Analysis of the fossils

When carrying out evaluations of the fossils, scientists take into account many factors which include, but are not limited to, the measurement of the relative proportions of the limb bones, skull morphology, architecture of the hands, wrists and shoulders to determine whether or not the specimen is consistent with knuckle-walking and or brachiation (moving by swinging with the arms from one hold to another), examination of the legs and hips to determine whether or not the creature was a biped. Examination of the semi-circular canals also provides clues as to the normal orientation of the creatures. Anthropologists put all this information together when they try to determine the evolutionary history of humans.

Humero-femoral index

One important characteristic is the ratio of the length of the arms and legs (usually expressed as the humero-femoral index). Apes have longer arms than legs, while humans have arms that are shorter than their legs, therefore the humero-femoral index of apes varies from about one to 1.3, while that for humans is about 0.7. Richmond *et al* (2002) have reported that the humero-femoral index for *Ardipithecus* and *Australopithecus* was about one.

Australopithecus robustus. This species has a larger and more robust skull and teeth than A. africanus and the average brain size is 530 cc. *Courtesy of Dr Vij Sodera, www.onesmallspeck.com*



A display of skulls at the Natural History Museum – clockwise from the top, *Homo sapiens* (human), *Homo neaderthalensis, Homo habilis,* and *Australopithecus* sp. *Courtesy of Dr Vij Sodera, www.onesmallspeck.com*

Brain size

Ardipithecus and *Australopithecus* had a brain size of around 400ml, while *H. habilis* specimens generally have brain sizes of about 600 to 800ml. The brain size of *H. erectus* (about 900ml) is smaller than the average value for modern humans (which average about 1300ml). It is assumed that these findings show the evolution of the large human brain.

Knuckle-walking

Studies of the hands and wrists of *Australopithecus afarensis* and *anamensis* show that they "retain specialized wrist morphology associated with knuckle-walking" (Richmond and Strait, 2000).

The significance of this is unclear. Most seem to consider these features to be vestiges of a knuckle-walking past. However, we would suggest that *Australopithecus* would have used both knuckle-walking and bipedalism.

Brachiation

Apes have arms which are designed for brachiation. The structure of the arms and shoulders of *Australopithecus* is consistent with this mode of locomotion. Some specimens also have curved finger bones which are a feature of tree-climbing creatures.

Semi-circular canals

The semi-circular canals are organs of the inner ear which allow us to balance and orient ourselves in space. The orientation of the semi-circular canals reflects posture and balance. The plane of orientation of australopithecine inner ear canals revealed by CAT scans shows that they would have been able to move effectively by switching between bipedalism and arboreal climbing (Spoor *et al,* 1994). Furthermore, they concluded that only *H. erectus* could be considered an obligate biped, while a *H. habilis* specimen was not.

Discussion

There are a number of issues which should be mentioned in any discussion of human origins. Firstly, even the best fossils are fragmentary. Secondly, assigned dates conflict with "advanced features" and thirdly, there is a conflict of opinion among the experts.

Fragmentary fossils

Many of these fossils are fragmentary (even the well-known fossil "Lucy" is only 20% complete) and therefore interpretation is difficult and sometimes inconsistent. An example of the conflicting interpretation can be found in the papers by Richmond *et al* (2002) and Haeusler and McHenry (2004). The first concludes that *H. habilis* was more ape-like and the latter conclude that it had a body of essentially human proportions.

There is continued disagreement about which specimens should be attributed to which species. This is a particularly acute problem for *H. habilis* but is also a problem for *H. erectus.* A review of the literature on *H. habilis* shows that different researchers attribute different specimens to *habilis,* and few can agree on what traits define *habilis.* It seems that *habilis* may not be a valid species at all, while others have suggested that it should be called *Australopithecus habilis.*

Dating versus form

The dating of specimens also leads to difficulties. This is linked with the question of which specimens are ancestors of modern humans and which are "evolutionary dead-ends". The Laetoli footprints are dated at 3.6 million years and were clearly made by a foot that is not distinguishable from the foot of a modern human who habitually goes barefoot. A very modern looking maxilla (AL 666-1) has been assigned an age of 2.3 million years. Yet we are told that the earliest *H. sapiens* is no more than a few 100 000 years old. The recently published evidence suggests that *H. habilis* and *H. erectus* lived at the same time (Spoor, 2007). Therefore, the idea that *H. erectus* arose from *H. habilis* is in considerable doubt.

Conflicting expert opinion

It should also be noted that the different fossil experts, in their different interpretations of the evidence, have between themselves probably ruled out all the fossils as human ancestors. This suggests that a case could be made that none of them are fossil ancestors of humans.

This brief review shows that the currently available evidence is not sufficient to allow anyone to claim that they know how we evolved from apes. Indeed as more fossils are discovered it appears that the story becomes more complicated. The large variety of different species and the fragmentary nature of much of the evidence provide plenty of opportunity for various speculative pathways to humans. Few experts are now willing to make definite statements about how hominid evolution has occurred.

Evidence versus assumptions

Evolutionists agree that there was an increase in brain size, a change from knuckle-walking and tree-climbing to obligate bipedalism and an increase in manual dexterity. However, the details remain unclear and there is no general agreement on what caused these changes and the exact sequence of events. Arguably, rather than being a conclusion springing from the fossil evidence, some scientists are looking for evidence to show a series of changes involving a transition to bipedalism, increasing brain size and an increase in manual dexterity, because that seems the most logical way in which we might expect an evolutionary pathway to occur. The proposed sequence of changes is, therefore, based on assumptions that provide a framework within which the evidence is interpreted.

Possible alternative explanations of the fossils

The *australopithicine* specimens are clearly from a group of animals which could move on the ground both equally well on two legs or by knuckle-walking (like gorillas and chimpanzees), while also being capable of moving through trees by brachiation. Bonobo apes are modern creatures which are probably very close to *australopithicines* in terms of locomotory repertoire and they spend a good deal of time walking upright, suggesting that australopiths are no more than extinct apes.

One of the contested links between humans and apes is *H. habilis,* which, as we have seen, is a mixture of various different fossil specimens that probably do not belong together. It is fair to say that some of the *H. habilis* fossils could be assigned to genus *Homo* and others to the *Australopithecus.* However, while this is not necessarily fatal to the evolutionary story, it does show that the evidence is not conclusive and is open to many different interpretations.

Evolutionists emphasise the small brain size of *H. habilis* and *H. erectus* as evidence for evolution and this is perhaps their strongest argument. However, the absolute minimum for human brain volume is not known with any certainty. Indeed it is agreed that architecture is more important than volume. The minimum for a normal modern human is about 1000ml and *H. erectus* with a brain volume of around 900ml is very close. There is no good reason to assume that *H. erectus* was less intelligent than modern humans, therefore, it seems that it could have been human.

Evolutionists claim that the fact that it is difficult to determine whether some fossils are human or ape shows that they are transitional. It seems likely that the problem arises because of the fragmentary nature of the evidence. Evolutionists predict that as more fossils come to light the transition will become clearer. However, we predict that, as evidence accumulates, it will become clear that fossil apes were ancestors of modern apes and fossil humans were ancestors of modern humans.

The evolutionary story is further challenged by fossils such as the maxilla labeled AL 666-1. This appears to be human and the only problem with this interpretation is its supposed age of 2.3 million years which, according to the evolutionary paradigm makes it too old to be human. The same can be said for the Laetoli footprints.

A good case could be made for considering some *H. erectus* specimens, with brain sizes around 900ml to be fully human, consistent with the great morphological variety present within the species *H. sapiens.* Indeed it should be noted that humans today show a wide variation in morphology, from the various tribes of African pygmies, to Europeans, to the Maasai and to the Inuit.

Conclusion

As we have seen, there are many difficulties with the evolutionary account of human origins. The fragmentary evidence results in differing opinions on whether a fossil is a human ancestor or a creature which left no descendents. Indeed, as has been pointed out by Lieberman (2007) the picture has recently become more complicated with the discovery of new fossils from Georgia. It seems that there is a need for much more conclusive evidence before anyone can claim to have proved that we evolved from an ape-like ancestor. However, we believe that as more fossils are analysed it will become clearer that humans could not have evolved from ape-like ancestors. ■

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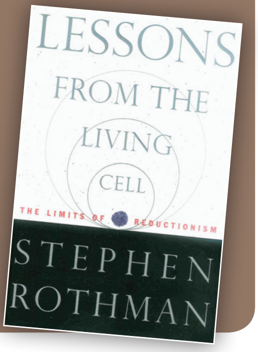
Picture of Turkana boy (KNM-WT 15000 An almost complete skeleton of an 11 or 12 year old boy, *Homo ergaster* Except for the skull, which is smaller at around 880 cc, the skeleton is largely similar to that of modern humans. Conventional dating 1.5 to 2 million years ago. *Courtesy of Dr Vij Sodera, www.onesmallspeck.com*

Lessons from the Living Cell

by Stephen Rothman.

McGraw-Hill, New York, 2002.

Reviewed by Professor Colin Reeves



This book carries the subtitle "The Limits of Reductionism", and it is indeed intended as a critique of the extreme reductionist view of science – the view that characterises the writings of Richard Dawkins, for example. However, it is also a fascinating account of the way in which biological research is carried out in practice, and how one's worldview colours one's scientific methodology.

Stephen Rothman is one of the world's leading experimental biologists, with a string of papers in the most important journals to his name, having worked as a research professor at both Harvard and the University of California, San Francisco, where he spent years investigating protein transport systems in biological cells. He is clearly well-qualified to explain and critique the relevant theories.

The first 6 chapters are concerned with Rothman's attitude to reductionism as scientific explanation. Reductionism is traced back to Descartes and Newton (and even further back to the Greeks, notably Democritus), and can be summarised by the doctrine "the whole is the sum of the parts". In other words, scientific explanations in biology can be reached by taking living systems apart and examining their components – if need be, right down to their individual molecules. Rothman distinguishes between several different varieties of reductionism; as a basic general principle of scientific methodology it can be valuable and helpful, but it tends to take over more and more and become metaphysical in character. Ironically, taken to the extreme of what he calls "strong micro-reductionism" it actually distorts the process of science. The strong micro-reductionist outlook is what Donald Mackay used to call "nothing buttery": the whole is the sum of the parts, and *nothing more* (p. 43). In the case of the cell, Rothman thinks this view is greatly mistaken.

The second half of the book (chapters 7–13) comprises two case studies, the more substantial of which is an extended reflection on Rothman's own struggle to overthrow one specific biological theory – the vesicle theory concerning the transport of protein molecules within the cell. Within the pancreas, there are cells (*acinar* cells) that manufacture enzymes for the purposes of digestion. The problem is that the proteins (enzymes are proteins) are made at one end of the cell, but secreted (i.e., made available to the digestive system) at the other. How do the proteins get from A to B? It appeared axiomatic to biologists that the proteins could not cross the cell membrane on their own, so they devised an elaborate scheme whereby the proteins are transported by tiny objects called *vesicles,* which travel around the cell "like so many minibuses." A Nobel prize was awarded to the progenitors of this scheme, yet Rothman finds the evidence less than convincing. In his view, the experiments that purported to establish the theory were flawed by their reliance on the micro-reductionist dogma. Every experiment could be *interpreted* as supporting the vesicle transport theory, but in fact nobody has ever observed the process as a whole.

The finer details are probably only appreciated by a biologist. However, Rothman takes pains to explain things thoroughly and clearly for the non-specialist, and he builds a convincing case. Problematic experimental results were explained away as artefacts of the experimental process. Experiments that could have falsified the theory were not carried out. When he and his colleagues did such experiments (which duly falsified the theory), the results were disbelieved or discounted. A specific prediction of the vesicle theory (so-called "parallel secretion") was shown to be false in at least some cases. Other experiments showed that proteins *can* in fact cross cell membranes, contrary to the fundamental presupposition of the vesicle theory. Nevertheless, he accepts that most biologists still do not agree with him – a fact that he puts down to their prior commitment to micro-reductionism. Rothman is clearly disappointed that his views have been so lightly regarded, but his presentation is calm and judicious, and is nowhere coloured by ad *hominem* remarks or polemics.

There is however a great irony in his rejection of strong micro-reductionism. Chapter 5 is in the form of a dialogue between two scientists, Epistemon and Eudoxus (the names, and the dialogue concept, borrowed from Descartes), concerning the (im)possibility of a cell assembling itself. Rothman would concur with Michael Polanyi's statement that "life transcends physics and chemistry". It is absurd to suppose (as strong micro-reductionism posits) that we could take the chemical constituents of a typical cell and mix them up in some way so that they produced a functioning cell. But how then does it come about? Rothman's own "solution" to the problem of the strong micro-reductionist dogma is Darwinism! It is natural selection, he avers, that connects the parts to the whole, that takes physics and chemistry and turns it into life (p. 78 *et* seq.).

Yet everything that Rothman says about the vesicle theory in chapters 7–13 can be said of Darwinism. In spades. Consider some of the following quotations:

> My aim is to reveal how the vesicle model has been protected from falsification, and that this is a consequence of its strong micro-reductionist foundation. (p. 137)
>
> It may seem surprising to those not familiar with this field … that there can be great confidence in a functional model when a central aspect of its construction … is uncertain and in some respects unknown. But such confidence has abounded for half a century. (p. 150)
>
> Whether they thought the evidence convincing or weak, or were ignorant of it, many biologists soon came to believe that the vesicle model was not a model at all, but a description of an actual mechanism. The scientific literature reflected this sense of understanding. … Such descriptions did not highlight, or commonly even mention, the immense lacunae of ignorance, the various unanswered questions about the model's fidelity to the natural process. (p. 155)
>
> The specific mechanisms proposed were widely thought to account for the transport of proteins… And this belief went beyond the mere conviction that such a mechanism existed. It was commonly believed to be the sole mechanism. (p. 156)
>
> When evidence was reported that did not seem to fit the theory, it, not the theory, became suspect. … The absence of … anatomical forms predicted by the model … did not raise doubts about the theory, but instead led to an expanded search for the missing form. Sometimes negative observations were … turned on their collective heads, and viewed as evidence in support of the theory. (p. 156)
>
> And when negative observations did produce modifications in the model, its essential features were invariably retained. They did not lead to its rejection, or even weaken its hold, but instead gave rise to its elaboration. (p. 157)
>
> And finally, when negative observations were thought inexplicable and could not conveniently be rationalized, they were placed in the bottom drawer to await future knowledge that would, it was confidently assumed, explain them within the borders of the vesicle theory. (p. 157)

Finally, he sums up the situation as follows:

> It seemed that the vesicle theory was protected from falsification – immunized, invulnerable, whatever observations were made. Evidence of all sorts … was interpreted to bolster the theory's claims. In this way the vesicle theory was *explicated* by experimentation, but never *threatened* by it. (p. 158)

In Rothman's case, these statements concern the vesicle theory, or some facet of it. But all these criticisms can be justly charged to Darwinism! Biologists are brought up in this way of thinking in regard to the overarching theory of biology – consider Dobzhansky's oft-quoted aphorism:

> Nothing in biology makes sense except in the light of evolution.

Is it any wonder then, that the same principles are applied in the case of a particular biological theory?

So Rothman is correct, insofar as there are some key lessons to learn from the living cell, and his book certainly makes fascinating reading on more than one level. But the most important lesson is not learned here – the fact that the "irreducible complexity of life" (to quote Polanyi again) not only cannot be accounted for by physics and chemistry, but cannot be accounted for by Darwinism either. Rothman fails to see it, but Darwinism is shot through with the strong micro-reductionist mindset. Darwinism insists that complexity can be explained simply by invoking natural causes, and given its entrenched position in biology, it is no wonder that individual theories *within* biology show the same characteristics – accommodationism and expansionism in regard of new evidence, impermeability to negative observations, immunity to falsification, and great confidence in the "mechanism" coupled with wilful ignorance as to the details of its working.

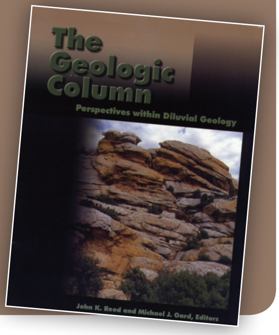
As Behe, Dembski, Johnson, Meyer and others in the ID movement have argued, complexity can only be gained by the input of information, and everything we *know* about complex systems (as opposed to what may be hypothesized) tells us that this can only come from an intelligent source. ■

The Geologic Column: Perspectives within Diluvial Geology

J K Reed and M J Oard (editors).

Creation Research Society Books, Arizona, 2006. 157 pp. **US$ 15.00**. ISBN 978-0-940384-34-7.

Reviewed by John Peet



Though the Bible makes no mention of fossil formation or of rock deposition, it is generally agreed among creationists that these should be related to the Noachic Flood (Genesis 6–9). The non-biblical approach is to consider these rocks as a record of the evolution of life. This is a major contradiction of the biblical creation which sees the event as good. The rocks speak differently: disaster, agony, death. Creationists agree that judgment on this scale must be related to the Flood. But how? There is debate about how much of the rock record is formed in the Flood and how much is post-Flood. (Some would also see the lowest strata as consistent with the Creation record through to the Flood). The other area of dispute is how reliable is the concept of the geological column which is a construction seeking to correlate the observed rock types and their sequence across the planet.

This book is a symposium of papers seeking to present the various views and, hopefully, leading in the long term to an agreed scenario on which creationist geology can be developed. I picked up the book with eager anticipation but found it to be frustrating at times! Dr David Tyler, our *BCS* secretary, who has done considerable work in this area (together with others of our Society) contributes two chapters. I admit to a bias, but I did find those chapters to be among the most satisfying.

All the writers are agreed that the Scriptures should determine our interpretation of the data. However, I did feel at times that the Scriptures were not allowed to speak for themselves. The first question must simply be, "What does the Scripture say?" It is easy to force it into our mould. One of the fundamental principles of the *BCS* is just this. As a consequence, over the years the *BCS* geologists have found themselves developing a different approach to the data from that held more widely by creationists. The second question is, "What does the rock record require us to acknowledge?" My experience is that when we take this sort of approach, it is not too difficult to align these parallel approaches where we see clear correlations. They may not be what we expect, but we are not then forcing the Bible to fit academic arguments. We must be careful not to impose statements that the Bible does not make. As mentioned above, the Bible does not comment on the rocks and fossils, yet Reed *et al.* write, "the Bible posits the catastrophic emplacement of rocks, predominantly in a unique Flood" (p. 132). That's an interpretation!

To summarise detailed arguments from the book is to run the risk of misrepresenting the writers. I do, therefore, urge readers to check my comments against the papers themselves. In the chapters that are seen to be presenting differing views, the other authors are allowed to question the writers who have a right of reply. This is often useful for clarifying significant points.

The first chapters lay a foundation for the book. The editors, in their introduction, present a very detailed version of the geological column (p. 5) which the non-specialist will find useful as a reference tool through the rest of the work. Terry Mortenson helpfully reviews the historical development of the now popular old-earth timescale. As we have come to expect of Terry, this is very thorough.

John Reed *et al.* write an introductory chapter, "Towards a Diluvial Stratigraphy." I had mixed reactions to this presentation. Though it has a significant foundation to the theme of the book, it often seemed to be dealing with the evolutionist naturalistic approach rather than the creationist debate. They seem to focus their criticism to**** the atheistic evolutionists. A more useful approach (particularly in the light of our biblical bias) would have been to tackle theistic evolutionary perspectives. I found some of their comments surprising, such as, "Many creationists exhibit a surprising difficulty in differentiating between the enterprises of science and history" (page 39). Similarly, on the same page, they quote one of their team stating, "Most, if not all, of these attempts to reconcile Scripture to the global evolutionary stratigraphic column have come at the expense of the biblical record." Such sweeping statements as these are remarkable and, I find, unjustifiable. It does reflect their own bias, a sceptical approach to the geological column!

In chapter 4, David Tyler joins forces with Harold Coffin to promote acceptance of the geological column but reject the evolutionary chronology associated with it. By combining UK and US authors, they were able to present a strong argument based on field work in both countries. I found this chapter to present a strong case. This is probably a good place to express a disappointment at the publisher's presentation of the book. The grey-tone photographs throughout the book were not helpful. Colour photographs would have added to the clarity.

David then presents his proposal in "Recolonisation and the Mabbul". A useful, non-specialist approach to this *BCS* position was presented by Michael Garton in *Origins* some years ago and should be "required reading"! (See *Origins*, 1990, 3(8):4–7; 1990, 3(9):4–9; 1991, 4(10):3–8; 1991, 4(11):8–13; 1993, 6(15):17–22;

1997, (22):11–24). The basic argument is that the biblical account is of a flood of catastrophic proportions, far greater than what we experience now. As the *tsunami* of Christmas 2004 demonstrated, death and destruction come suddenly and in *seconds.* (If, as the Bible tells us, the Flood was so dramatic, there would have to be a confusion of fauna and flora in the initial fossil record. That does not occur. If the events proceeded as David describes, that confusion would not be seen***** due to the re-working of the rocks through metamorphism.) The Hebrew uses the word *mabbul* (catastrophe), translated as flood, only of the initial forty days. The thesis of this chapter is that the *mabbul* action is to be found in the Hadean/Archaean. Subsequent activities of the "Flood year" and post-Flood disturbances would correspond to later sections of the geological column. Using the Scriptures as his guide, David takes us through the possible scenario displayed in the rock record. This is a very readable chapter.

Chapter 6 was, to me, the least satisfactory ("A Long and Winding Way" by Emil Silvestru). At times I found it difficult to be sure of what he was saying. His basic point, with which we would agree, was that the geological timescale was a biased interpretation of the data.

We move back to the main symposium in chapter 7 in which Michael Oard argues for a "middle way". He believes, with Tyler and Coffin, that local***** stratigraphic sections do line up with the geological column in many places. But, he also argues that there are many problems which means that we need a more complex interpretation. He favours an approach which says that the relationship of the rocks with the Flood will vary from location to location. For example, the Cenozoic could easily be early, late or post-Flood depending on its location. One of the problems I find with this approach is that it effectively ignores the biblical description of the Flood as global. As with Tyler *et al., I would want to look for global structures to correlate with* the Flood, especially of the *mabbul* period. Local variations would then be post-Flood. Michael acknowledges (p. 101–102) that out-of-order strata only occur in areas of orogeny (mountain building), but in other comments he appears to see such strata as a problem for a global column. Another supposed problem to the global column concept, he believes, is the localised absence of certain strata. But why? They may have eroded away or they were not formed in all local geological events. This is especially true in the post-Flood period. Oard's comment on the trivial nomenclature of the rock layers (p. 106) and so their subsequent relabelling if the geologist's whim requires it seems a little unfair – or, am I being naïve? There are a number of other issues arising from this chapter, but hopefully these comments give a flavour of Michael's model.

The last chapter of the symposium is by Reed *et al.* They reject the validity of the geological column, but this seems to be more philosophical than real! They prefer to use the term "Rock Record", understanding it in a purely local sense. As in their earlier chapter, I find that they introduce some terminology which needs clarification for the non-geologist. They often use analogies which I find to be trivial**** and unhelpful. They comment that "history is by definition interpretative in a manner that science is not" (p. 127). I am puzzled by that statement and wonder what their definition of science might be.

There is a tendency to reject the geological column concept because of the "chronological identity" with the evolutionary schemes imposed on it (p. 131). But this is not what most creationists think of; it is related to sequential events which only have a chronological significance when they are linked to the researchers' paradigm, in our case, biblical. The discontinuities observed are what one expects in the Recolonisation Model (as described by Tyler). Science, as practiced by non-christians, is indeed defined by naturalism (p. 134), but we who are Christians see it as the hand of God in His world.

The book finishes with the editors identifying agreements and disagreements between the researchers. Following on from the latter, they suggest key areas for further research, scientific and biblical. They propose some useful topics for scholars in biblical Hebrew which might help to clarify the issues underlying the recolonisation model. Any volunteers?

It is some years since the publication of *The Genesis Flood* by Whitcomb and Morris. It was a landmark in creationism but the authors recognised it was unlikely to be the last word on the subject, even though some folk have used it as a criterion for orthodoxy! The time has come for a book of this kind, *The Geologic Column.* It is good to see the respectful questioning and probing of each other's models – much better than throwing brickbats in the journals! Thank you, *CRS,* for publishing this volume. ■

> *editorial continued*

accepted that natural causation has been the rule throughout time, with the significant exception of redemptive miracles. Consequently, they are unable to challenge the evolutionary atheist on this point and their position comes across as irrelevant: why postulate a God just to make the laws of physics and chemistry work? The atheists perceive this belief as superfluous and say that it is time we grew up.

The biblical creation message is quite different. God has acted in history from the beginning of time in miraculous ways. These actions are not to be described in terms of complementarity. He has created the heavens, the Earth and all the living creatures according to his eternal power and wisdom. He made Adam and Eve after His own image and placed them in the Garden of Eden. After their disobedience to his command, He pronounced judgments and cast them out of the Garden. In the time of Noah, He brought the Flood upon the Earth as a judgment upon Adam's rebellious descendants. Later, he confused the languages of Noah's descendants, again because of their pride and ungodliness. Many TEs regard these accounts as ahistorical stories with a message, divorcing history from theology. However, this hermeneutical device is alien to the Bible, where God acts in history and reveals the meaning so that we understand his mighty works.

God's creation displays His eternal power and wisdom. Both of these characteristics are grounds for apologetic activity. The inability of natural causation to explain origins should be regarded as evidence. The more research confirms fundamental problems with naturalistic explanations, the less convincing is the claim that this is "god of the gaps" thinking. The extraordinary complexity of living things provides ample material to witness to God's wisdom.

Consequently, we remain convinced that the Biblical Creation message is a vital part of the Church's apologetic ministry. Confronting evolutionary atheism without this message is like going into battle without knowing our opponents and brandishing inappropriate weapons! Just as we have to engage with evidences in apologetics when we address biblical archaeology, so also is this the case when we address the biblical record of origins. This is a strategic issue for the Church of Christ to face, and we have a long way to go before leaders grasp the nettle. At a recent conference in Edinburgh (which I attended) organised jointly by Christians in Science and the American Scientific Affiliation (who represent most Christian academics in the UK and the US respectively), there was almost no interest in addressing the tensions between biblical history and evolutionary account of origins. This is an indication of the immense task before us. It is not impossible to change this situation, because God is able to guide His people into all truth. However, it is a task that should drive us to pray for more labourers in the field of science who have the vision of developing a biblical worldview. ■

David J. Tyler.

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Single Issue Price

The price of a single issue is £5.00 plus postage.

Origins 27 was a special issue with a price of £3.50 plus postage.

Origins 37/38 was a special issue with a price of £6.00 plus postage.

Credits and Acknowledgments

Design by four-nine-zero design.
www.fourninezerodesign.co.uk

Printed by Graham & Heslip, Belfast.

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ISSN 0953-2773

Origins is published three times a year by *The Biblical Creation Society*

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